# COASTAL POLLUTION STUDIES AT THE HARBOR BRANCH FOUNDATION LABORATORY

by

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Scientific studies at the Harbor Branch Foundation Laboratory are for the most part concerned with an assessment of the local environmental quality of the Indian River lagoon area from Ponce de Leon Inlet, near New Smyrna Beach to Jupiter Inlet near Tequesta, Florida. The study also includes the barrier island system and the shallow nearshore areas along the same stretch of coast.

In the past two years since the opening of the Laboratory, a number of projects have been undertaken involving the submersible "Johnson-Sea-Link". (A film of a portion of the hyperbaric studies at Duke University, undertaken by the Harbor Branch Foundation, will be shown at the close of the paper).

The author's own research activities are related to an assessment of the role of sabellariids, reef building marine organisms, in the nearshore waters along the lower East Florida Coast.

These animals and the reefs they build are widespread in turbulent, sediment laden waters of the world's shorelines, and are particularly abundant along the coast of Florida from Port Canaveral to Biscayne Bay, near Miami.

The reef building animals occupy a discrete zone from about mid-tide level to mean low water and are found growing on the rocks at jetties, on wooden and concrete structures, such as on fishing piers and bridges over inlets. They are also found growing at depths down to about 3 meters. (Closely related members of the Family Sabellariidae are also found at great depths in the oceans, but these remarks refer only to the nearshore forms).

At places, these reefs are large and continuous enough to exert a strong influence on the movement of sediments by wave- and tide-generated currents near the beach zone.

In the course of the research conducted with these organisms, it has become apparent that there may be some lessons in the design of coastal erosion defenses which might be learned from them.

For example, if growth sites (habitats) could be emplaced along the shoreline at appropriate locations with respect to factors such as: the wave and current directions, the average energy flux of the breaking waves, the slope of the beach and the amounts, orientation, and particle sizes of the sand in the beach and in longshore bars, it might be that in addition to the modifications of the flow patterns compelled by the artificial structures, there would also be the likelihood that the larvae of the reef building animals would settle on these structures. The encrustations they would form could conceivably grow to a thickness of 1/2 of a meter or so, and thus greatly enhance the surface area and mass, and increase the efficiency of the artificial structures.

This in turn would absorb, reflect, and refract the breaking waves which would otherwise reach the beach with their energy undiminished and the normal on- and offshore movement of sand would be greatly retarded.

In order to test this notion, a hydraulic model study was conducted at the Coastal and Oceanographic Engineering Laboratory, University of Florida, Gainesville.

While the study was designed by the author and sponsored by the Harbor Branch Foundation, the actual tests and measurements were conducted by Dr. A. J. Mehta, with the assistance of Mr. Eric A. Sedwick and Mr. H. S. Hou. Professor M. P. O'Brien also participated in the design and completion of the model study.

Actual field measurements of the beach and foreshore profiles were made along transects where the natural reefs are present (on Hutchinson Island, Martin Co., Florida) and also at localities which are unprotected by reefs. Measurements were made of the angle of wave attack and the average wave height during the transition

from summer to winter wave regimes and beach forms. Sediment samples at these transects were taken and analyzed and the direction and rates of movement of the nearshore water were examined.

These factors were incorporated into the design of a wave-tank model and the consequence of the presence or absence of the reef was examined in terms of the dynamic similarity between the actual measured conditions found in the surf zone and those conditions which can be simulated in the laboratory wave-tank.

The model study showed that the natural conditions could indeed be scaled down to a manageable size and the complex variables can be isolated and measured with credible precision. The energy of the breaking waves of various wave regimes was greatly dissipated by the artificial reefs and the rates of movement of the sand over and behind the reefs was, likewise, greatly reduced. Additional studies are in the planning stages and, depending on their outcome, we may be able to make a substantial contribution to the solution of beach erosion problems.

The reefs also develop along the insides and floors of inlets. These growths modify the pattern of water circulation and sand movement in the inlets. They also pose a menace to unwary boatmen. Additional research is being conducted to determine possible means of controlling these inlet growths without drastically modifying the tidal flow patterns through the inlets. The information obtained by these studies may, perhaps, provide additional insight into the re-design and maintenance of existing inlets where these reef build-ups are troublesome.

Interesting research is being conducted at the Harbor Branch Foundation Laboratory to determine the early growth stages and life histories of marine organisms. This fascinating aspect of marine biology is being studied by specialists at the Laboratory. Dr. Mary E. Rice, of the Smithsonian Institution, is working with species of a little known group of organisms called Sipuncula. These animals are found in both the Indian River and the ocean areas. Plankton surveys and field collections are made on a continuing basis and the stages of growth and relative abundance of the animals of various ages are determined.

Dr. K. E. Eckelbarger is making similar studies of the life histories of marine polychaetous annelids (bristle worms) including the development and growth of the reef-building Sabellariidae.

Both workers maintain live cultures in aquaria in the Laboratory where the conditions of life in the ocean can be simulated and the transformations these animals undergo in their life-cycle can be carefully studied.

The Indian River Study, being conducted by the Harbor Branch Foundation Laboratory, will make a general inventory of the organisms and sediments in the local area. Other factors such as water chemistry and pollution levels are being measured. When this survey is complete and the many distributional and ecological factors are computerized and collated, a more comprehensive assessment of the prevailing conditions of life forms and the changes induced by human activities can be made than previously possible.

This will be a thesaurus of knowledge which will be of local interest and importance to future planning of recreational and urban use of the priceless lagoon. Additionally, the purely "scientific" aspects of the study will be of great use to workers engaged in related studies throughout the world.

A large facility for ocean-oriented engineering projects is presently being built at the Ft. Pierce base which will greatly enhance the capability for construction of submersibles and support vessels and equipment. A new submersible support vessel, the "R/V Johnson" was recently commissioned and is now engaged in "shakedown" operations. The refurbishing of the ship was done at the existing facilities at Link Port.

Other activities at the Laboratory include chemical engineering studies of filtration and absorption devices for purifying the air in the compartments of the submersible, a study of sea water use in sewage plant processes, and a mariculture project.

In the Florida Keys, another study is in progress to examine the growth and destruction of the coral reef tracts. This study involves the integration of biological and sedimentological techniques employed to derive a coherent assessment of prevailing ecological conditions. In particular, the study is designed to examine the effects of dredging and other human activities which might inhibit the continued growth of the coral reef system.